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ADDING COMFORT AND ELEGANCE TO LEATHER—Page 8

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Research for Appalachia

The war on poverty in the mountainous region of the eastern United States will be an arduous battle—to be won on the home front, not in Washington, D.C. For the causes of poverty will have to be rooted out locally and replaced by productive and lasting enterprises.

Forces within government and without are trying to improve economic conditions in Appalachia. As a member of the USDA team, ARS is providing help from research.

Especially helpful are new and improved products and processes developed by ARS from agricultural commodities. Some of these products could be processed from commodities now grown in Appalachia (apple flakes and shearling bedpads, for example, discussed in this issue). For this reason, they might serve as the basis for one or more agricultural processing plants in Appalachia.

A weapon against poverty could be as simple as a new ARS-Georgia method of eliminating swine kidneyworms. Producers of feeder pigs in Appalachia can rid their farms of worms in only 2 years by: (1) Using only gilts for breeding and marketing the gilts when their pigs are weaned; (2) Eliminating all older hogs from areas where hogs are raised.

Weapons against poverty also include practical information on the production, processing, and storage of foods for use on the farm; on housing that is designed for the comfort and safety of older people (AGR. RES., July 1964, p. 14); and on specialty crops and products that will add to farm income.

Because trees are such an important resource in Appalachia, the potential for specialty products like maple sirup should be considered. Many owners of maple groves have tapped into this historic income reservoir, using updated techniques based on research (AGR. RES., January 1963, p. 10).

(EDITOR'S NOTE: Rural community development groups may obtain information on new products and processes by writing to: Utilization Research, Agricultural Research Service, U.S. Department of Agriculture, Washington, D.C., 20250.)

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Will Lorna Change Feeding Patterns?

Star performer in dairy studies reveals role played by body fat in heavy milk production

■ New ideas for dairymen—about feeding high-producing cows—may come from basic ARS studies of the role that stored body fat plays in heavy milk production.

The studies show that high milk producers have a remarkable ability to draw energy from stored fat during production peaks and to replenish the fat when milk flow lessens.

Dairy nutritionist W. P. Flatt gives an exceptionally cooperative cow named Lorna (AGR. RES., June 1964, p. 16) much of the credit for new insights into the mechanics of high production.

To get the precise data needed, Flatt and his team of researchers are confining cows in airtight, individual chambers. They monitor the cows for every breath of air they take, every ounce of body waste they excrete, every time they stand up or lie down, and every calorie of heat they lose.

"We have other relatively high-producing cows that have provided helpful information, but Lorna is the star in our energy metabolism laboratory," Flatt reports.

Lorna produced 19,331 pounds of fat-corrected milk (adjusted to 4 percent butterfat) in 305 days. During peak production, she produced almost twice as much milk per day as the previous record producer in an energy metabolism laboratory.

During the first 89 days of lactation, Lorna produced 9,433 pounds of milk, which required 15,000 more calories (kilogram calories) of estimated net energy per day than she drew from her feed. A weight loss of about 330 pounds of fat apparently enabled her to give 3,000 more pounds of milk than she would have given without this stored energy source.

From the 90th to the 175th day of lactation, her weight held about steady. During the last 130 days, however, she consumed many more calories per day than she needed for milk production and maintenance—and she rapidly restored the fat she had lost.

Studies of the way in which Lorna lost and regained fat may lead scientists to revise concepts of the proper way to feed high producers.

Dairymen presently follow the principle of "challenge feeding." This method accepts the fact that many cows can't eat enough of the

Despite being sealed off in a glass enclosure, Lorna produced 19,331 pounds of fat-corrected milk in 305 days. At peak production, she gave almost twice as much milk per day as the previous record producer at any energy metabolism laboratory.

Will Lorna Change Feeding Patterns? (*Continued*)

usual ration to furnish the energy required for maintenance and peak milk production. It attempts to satisfy high energy needs by sharply increasing the energy content of the ration by substituting grains for roughage. (The boost in energy in the feed is tapered off as milk production drops.)

But by using stored body fat, Lorna closed the energy gap between what she could get from her feed and what she required for milk production. At that time she received a comparatively low-energy ration containing only 40 percent concentrates. Since a cow giving large quantities of milk cannot fully digest high-energy rations above a certain level, the question arises as to which supports peak production more efficiently: stored fat or highly concentrated rations. Scientists hope to find the answer in the continuing studies.

Lorna also alerted scientists to another feature of energy utilization. Late in her lactation, when milk flow required a lesser number of calories, she increased her feed intake and gained 4.1 pounds of apparently almost pure fat per day for several weeks.

"That's a phenomenally high rate of gain," Flatt comments. "Apparently, a cow like Lorna is especially capable of converting energy into fat toward the end of her lactation. She was consuming large quantities of a high-energy ration containing 80 percent concentrates without any apparent lessening of digestibility."

Feeding extra energy while a cow is milking at low levels again differs from current practice. Dairymen usually build up a cow later in the season—after she finishes milking and just before calving.

So on two counts, Lorna has given scientists reason to restudy the energy needs of high-producing cows. She and other cows in the energy metabolism laboratory will have to provide much more data, however, before scientists reach definite conclusions.☆

APPLE FLAKES

For sauce, cake mixes, dry cereals

■ Apple flakes that can be mixed instantly in water to make sauce . . . used in dry form in cake mixes . . . or mixed with cold dry cereals . . .

These new uses for apples have been made possible through a drying process developed by scientists at the Western utilization research laboratory, Albany, Calif.

The apple flakes, drum-dried from sauce, have a natural apple flavor and color and have proved successful in several commercial applications and trials, including dessert and cake mixes. They may find outlets also in apple butter, confections, and other baked goods.

Besides adding apple flavor, the flakes are particularly helpful in keeping cakes moist.

The developers of the drying process, engineers M. E. Lazar and A. I. Morgan, Jr., say that the product can also be compressed into small disks for use in dry cereals.

Although detailed cost studies have not been undertaken, the engineers cite the fact that drum-drying has proved low cost with various other products. Large savings are possible in packaging, storage, and shipping of the apple flakes, since the flakes occupy only 30 percent of the space and weigh only 20 percent of the canned equivalent.

The engineers explain that applesauce to be processed into flakes feeds between two chromium plated steel drums—0.008 inch apart, and rotating slowly toward each other at the top. The drums are heated with steam under pressure, at about 300° F.

As the drums rotate, the sauce coats them and dries as a thin film in little more than a half turn of the drums. During drying, air is drawn over the drum surface to remove water vapor. Once the film is dry, chilled air plays on it to firm the film and facilitate its removal from each drum by a stationary blade.

The pliable film then passes over perforated metal reels that have surface speeds slower than those of the drums. This increases the thickness and density of the film before it enters a dehumidified air chamber where it is collected. Finally, the film is crushed through a screen to reduce it to a flaky powder. Sugar may be added either before or after drying.

The natural color of apples is protected by the addition of as much as 600 parts per million of sulfur dioxide to the initial wet sauce. Almost all of the SO_2 is lost in the drying, and the remainder is not detectable in the well-preserved apple flavor.

Since, even for short periods, very dry foods absorb moisture when exposed to ordinary room air, the scientists held apple flakes of varying moisture content in air having different relative humidities and temperatures. In these tests, they established levels at which the flakes become plastic and sticky—information that makes it possible to maintain quality during production, packaging, and handling.

Lazar and Morgan made flakes from six varities of apples—Gravenstein, Rome Beauty, Red Delicious, Golden Delicious, Winesap, and Yellow Newtown—and found them about equally satisfactory as far as drying is concerned. The flakes, of course, reflected the quality and variety of the original apples.☆

Can Transoceanic Telephone Cables Be Buried?

Engineers study traction as part of research on protecting cable against fishing trawlers

■ A mechanical undersea machine capable of burying transoceanic telephone cables could emerge from a recent series of traction tests.

At the request of telephone engineers, ARS tillage engineers at the National Tillage Machinery Laboratory, Auburn. Ala., cooperated in a study of the kinds of traction such a vehicle would need to crawl along the ocean floor.

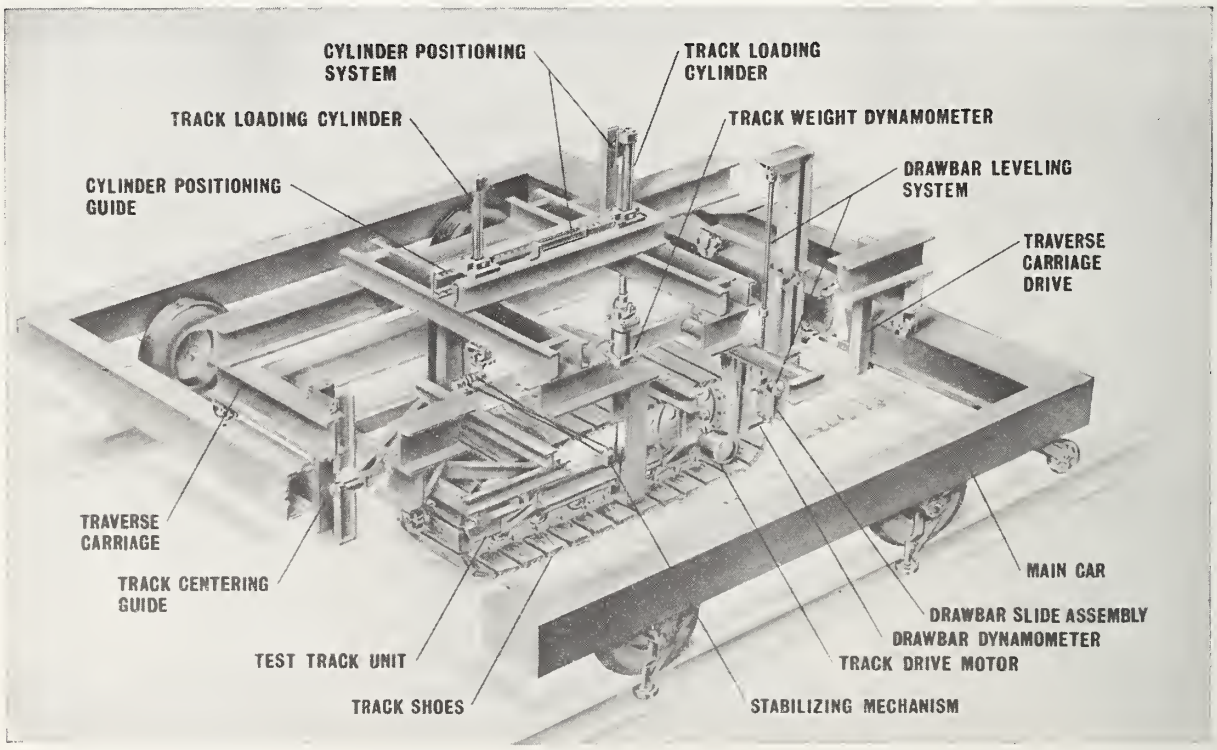
What concerned the telephone company was the damage to undersea cables often caused by fishing trawlers operating on the Continental Shelf. To avoid this damage, the company wanted to design a vehicle which could move along the ocean floor, dig a trench, and bury the cable beyond the reach of trawling equipment.

Scientists need similar traction information as it applies to the tillage of rice and other crops where fieldwork is done in wet or muddy soils. So a cooperative study was undertaken at the Auburn Laboratory; the telephone company provided some of the technical personnel and underwrote the project's cost.

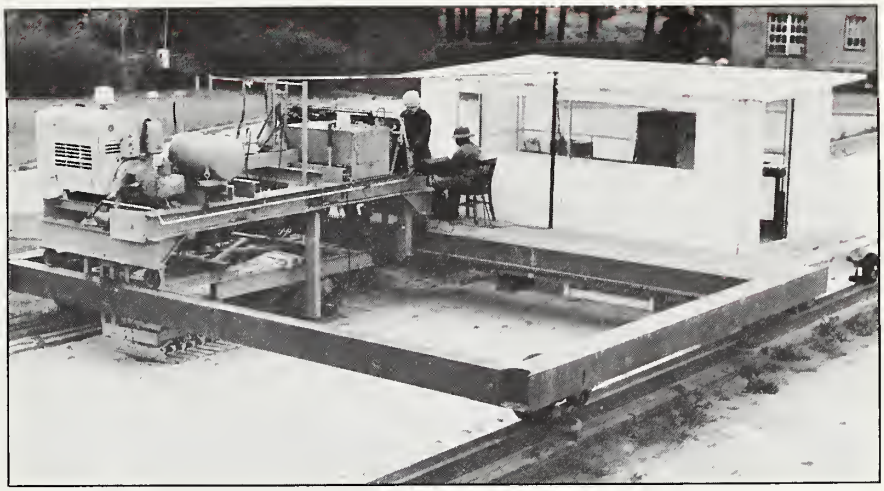
The engineers first designed and constructed a soil traction-measuring device which could roll back and forth over test plots (see photos). They then prepared soil beds of Lakeland sand, because of its similarity to sand on the Continental Shelves, and covered the beds with water.

By driving the measuring device back and forth over the submerged soil beds, the researchers were able to observe and evaluate all the factors affecting underwater traction.

Besides determining that a cable-burying vehicle could operate successfully in an undersea environment, the engineers established the following qualifications for traction devices to operate the vehicle on submerged



soils: (1) Low-speed operation; (2) narrow crawler tracks, actual widths depending on load distribution, and sufficient open space between individual tracks; and (3) center of gravity located near the front end of the vehicle.☆



ARS engineers established undersea traction principles on test plots filled with a type of sand similar to that found on the Continental Shelves.

Transmitting Animal Health...

Around the clock with miniature radios

■ ARS scientists have designed and built a radio transmitter that can be strapped to an animal as small as a pigeon or as large as a cow to obtain information about the animal's health.

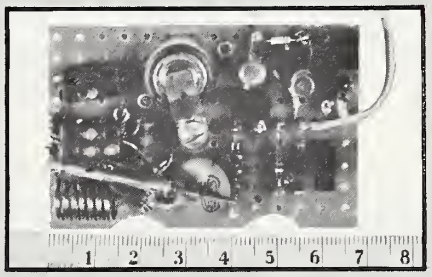
The transmitter makes it possible to observe a test animal continuously for as long as 2 weeks, the life of the device's single-cell battery. Capable of sending electrocardiograms, electroencephalograms, and respiratory rates to recording systems as far as 100 feet away, the transmitter replaces direct-line systems in which animals had to be restrained to keep them from breaking or fouling the wires.

The device weighs only 2⅓ ounces and does not interfere with an animal's behavior once the animal gets used to it. The radio is fitted into a plastic case about the size of a pack of cigarettes.

Such electronic instruments and techniques, coupled with biochemical tests made before, during, and after illness, are helping scientists better understand how animals react to disease. Aside from outward signs such as appetite, heart rate and sound, digestion, and fever, little information now exists about the changes that take place in an animal during an illness.

The transmitter was designed by engineer A. J. Stattelman and veterinarian W. B. Buck for use in the physiopathological section of the National Animal Disease Laboratory at Ames, Iowa. It was tested on cattle, sheep, chickens, and pigeons; and the accuracy and dependability of the radio transmissions were confirmed with recordings made simultaneously by a direct-wire system and radiotelemetry.

The transmitter consists of a preamplifier and a high-frequency oscillator. The 2-transistor preamplifier has a high-input impedance of 500,000 ohms and a low-output impedance with a voltage gain of about 4. The oscillator section contains one transistor, one coil, and two capacitors, whose values determine the resonant frequency.☆



Enclosed in a cloth harness, a tiny radio transmits information to recorders on this rooster's heartbeat, brain reactions, and breathing rates.

Adding elegance and comfort to . . .

GENUINE LEATHER

■ For comfortable, healthful footwear . . . for rich, soft garments . . . and for accessories of beauty and durability, genuine leather is hard to beat.

This is not to say that leather cannot be improved. Most leathers today are difficult to launder and easily attacked by perspiration. These and other limitations of leather are yielding to research by ARS chemists at the Eastern utilization research laboratory, Philadelphia, Pa., where a new method for tanning leather has vastly extended its utility.

The process, tanning with glutaraldehyde, is used widely now in workshoes because it resists perspiration and protects leather against hardening and cracking. It also resists many acids, alkalis, and detergents.

Glutaraldehyde does not wash out in laundering, and the chemists are now seeking dyes and other finishing agents that can be used to make leather a truly washable material.

In the meantime, glutaraldehyde has been applied to shearlings, sheepskins with the wool clipped short, which are used in hospitals and nurs-

Taking a skin from the tanning drum at the laboratory's experimental tannery are investigations head E. M. Filachione and chemist E. H. Harris, Jr. Both are conducting studies under the hides and leather research program.

COVER PHOTO—Sheepskins tanned with glutaraldehyde make cool, comfortable padding for hospital beds. Examining one of these shearlings are medical doctor James Deakins (left) of Philadelphia's Chestnut Hill Hospital and laboratory scientist W. F. Happich, who helped develop the new tanning process. Another shearling, being arranged for a patient, Mrs. F. R. Purnell, by assistant director of nursing Lorraine Prugh, has been used and laundered continuously for 8 months.

Glutaraldehyde tanning of leather produces useful and attractive items like workshoes and sheepskin jackets. They resist the deterioration and stains caused by perspiration and washing, as well as by various acids, alkalis, and detergents.

ing homes to prevent, and aid in curing, bedsores. The treatment makes bedpads more readily launderable.

Shearlings have been used traditionally as paint roller covers, but this market has been threatened by synthetic substitutes which are more resistant to water-based paints than conventionally tanned shearlings. Using glutaraldehyde in the tanning process for shearlings has permitted a return to this natural material.

Other ARS research has shown that pretanning sole leather with dialdehyde starch could reduce the tanning time by several weeks. The scientists are also conducting basic studies of leather that include microscopic investigations with both electronic and light microscopes (AGR. RES., July 1965, p. 8).

As a byproduct of research on leather, the scientists make available to consumers tips on the care of leather items—for example, the lacquering of old bookbindings to improve their appearance and postpone the necessity for rebinding. Saddle soap also proved effective in preserving leather-bound books.

Here are pictures of some of the results of this research—plus a few new styles in leather:☆

ADDING STYLE TO LADIES' LEATHER WEAR

Clothing manufacturers are adding style to a variety of new leather garments and accessories. Among them: ladies' suits, boots, purses, gloves, topcoats, shoes, hats—and even ball gowns.

Purified Diets Enable Scientists To:

- Prepare Better Pelleted Feeds
- Improve Feed Efficiency
- Study Functions of Rumen Microbes
- Create Proper Research Conditions

■ Purified cattle rations are proving a valuable laboratory tool in research at Beltsville, Md., making it possible for scientists to prepare better pelleted feeds for beef steers, improve feed efficiency in cattle, and study functions of microbes in the rumen.

ARS beef cattle nutritionist R. R. Oltjen, a leader in research on purified diets, explains that such rations are "pure" in the sense that they contain exact quantities of refined compounds. A diet can be made that contains, for example, precisely 154 grams of starch per kilogram of complete feed.

On the other hand, it would be next to impossible to determine precisely how much starch cattle on a natural ration consume on any one day. The amount of starch varies not only between silage, concentrates, and hay but also from sample to sample of each.

A purified ration eliminates this variance, because its contents are uniform and known from the start.

A typical purified ration for beef cattle consists of corn sugar, urea, cornstarch, corn oil, and wood cellulose plus minerals and vitamins. This ration costs about 15 cents per pound—quite expensive compared to commercial cattlefeed, which averages 3 to 5 cents per pound. But as a research tool, purified diets would be a bargain even at double the price.

Purified rations have been used in some form for decades but, until now, could not maintain cattle for long periods of time. Oltjen's ration has nourished a beef cow from weaning until past the birth of her first calf (AGR. RES., April 1965, p. 8). In view of this success, there is no apparent reason why the formula couldn't sustain a cow from birth until the end of her normal, productive life.

Oltjen is testing a purified cattle ration that does not even depend on natural feeds for proteins. Unlike purified diets for nonruminants, the new artificial ration contains urea as a nitrogen source; and micro-organisms in the rumen are counted on to build up proteins for their host from the nitrogen in urea.

Several beef and dairy scientists are using the new purified rations in trials with a variety of objectives:

1. Determine more precisely which nutrients are essential for cattle and at what levels. Currently, ARS scientists are investigating whether cattle require natural feeds containing the long-chain fatty acids for normal body function.

2. Create proper research conditions for other trials. For example, metabolic studies on how a cow produces milk are simplified by purified rations.

3. Analyze how pelleting affects certain feeds. Cattlemen have not been getting as good results with pelleted high-concentrate rations as with pelleted high-roughage rations; ARS nutritionists are using pelleted purified rations in trials to find out what causes the difference.

4. Find a cheaper source of protein. Urea, a simple and inexpensive nitrogen compound, already is used by cattlemen to furnish up to one-third of crude protein needs. Oltjen can carry beef cattle on a purified ration in which he completely replaces protein with urea. However, when all the protein is replaced by urea, growth is reduced to 75 percent of normal. Scientists are now searching for ways to improve the performance of cattle given nonprotein nitrogen sources.

5. Improve feed efficiency of cattle. A number of researchers use purified rations to search for methods to get more pounds of meat or milk per pound of feed.

6. Study functions of microbes in the rumen. A change in ration changes the proportions among active rumen micro-organisms. For example, the scientists found that when purified instead of natural rations are fed, the ratio of bacteria to protozoa is increased.

7. Reduce research costs. Results with purified rations can be interpreted more easily and precisely than those with natural feeds. Frequently, fewer animals are needed for each trial.☆

A New Forage Hybrid

Plant breeders cross sorgo with johnsongrass in research that could result in a new forage crop in the Southeast

Second growth of sorgo-johnsongrass hybrid extends above a 7-foot measuring rule. This particular plant is 2 years old.

■ ARS agronomist H. W. Bennett immerses sorgo flowers in water hot enough to kill the pollen-bearing organ (stamen) without harming the ovule-bearing organ (pistil).

This is Bennett's new technique for making sorgo flowers male-sterile. It may give farmers in the Southeast a more productive forage crop, a sorgo-johnsongrass hybrid. An experimental hybrid developed through use of this technique combines the higher carbohydrate content and yield of sorgo with the perennial habit of johnsongrass.

Bennett perfected the technique at State College, Miss., in studies cooperative with the Mississippi Agricultural Experiment Station.

In addition to its wide use for sirup production, sorgo is often grown for silage in the Southeast because it yields more forage than grain sorghum or corn. Johnsongrass, generally considered a weed, is being used in some areas of the Southeast for hay, silage, and supplemental grazing because it is persistent, palatable, and perennial.

Although Bennett has successfully used the hot-water technique on both species, he has so far obtained hybrids only when sorgo was used as the female parent.

Since sorgo is self-fertile, it must be made male-sterile to prevent self-fertilization before it can be used as the female parent of the hybrid. The stamen can be removed by hand, but the process is difficult, time-consuming, and not economically practical. Some type of mass male-sterilization is needed.

The hot-water technique may be the answer. Because of a difference in the thermal death point of floral organs in some sorgo plants, a temperature that kills the pollen may not harm the pistil. Growing plants are male-sterilized by immersing the panicles (heads) in a container of hot water for 10 minutes on the afternoon of the first day of flowering.

The success of male-sterilization is measured by bagging the panicle after it dries following treatment, shaking the enclosed panicle vigorously once a day for the next 3 days, and then determining seed set. Lack of seed set indicates that, as far as production of selfed seed is concerned, the panicles are male-sterile.

Bennett checks the effectiveness of the treatment by artificially pollinating treated plants, then examining them for seed set.

Using male-sterilized Hodo sorgo as the female parent, he has produced several sorgo-johnsongrass hybrids, which are now being tested for quality. Hodo was selected because it produces high forage yields and is well adapted to growing conditions in the Southeast.

Bennett points out that a sorgo-johnsongrass hybrid would not be difficult to control, even though johnsongrass is a very persistent weed. The hybrid's underground root system is restricted, and renovation is necessary to perserve it as a crop. Also, the seed of the hybrid is readily distinguishable from johnsongrass seed and they can be separated easily.

Bennett found differences in heat tolerance both within and between varieties of sorgo and plants of johnsongrass. Higher temperatures were needed to kill johnsongrass pollen than any variety of sorgo tested. Among the sorgos, florets of Hodo were most tolerant to higher temperatures. Successful male-sterilization occurred at 49° C. for Hodo, 48° C. for Tracy, and 47° C. for Wiley. The temperature necessary to kill the pollen in Sart florets also killed the pistil.

Soil moisture and relative humidity also affected the temperature at which male-sterilization occurred. Bennett notes that the longer plants go without added soil moisture and with low humidity, the higher the temperature must be for male-sterilization. For example, the temperature necessary for male-sterilization 4 days after an inch of rain kills or prevents opening of the floret if applied the day following the rain.☆

Limiting Cotton Tillage

Engineers reduce field operations from nine to four in west coast studies

■ Cottongrowers in the Far West may soon be able to reduce production costs—2 hours less tractor time per acre, for example—by tilling less frequently. But the operations they do conduct must be carefully selected, say ARS agricultural engineers at the U.S. Cotton Research Station in Shafter, Calif.

For the past four seasons, these scientists have been developing a new tillage system that cuts the number of field operations in half—from nine to four.

Most western cotton producers try to till the entire field uniformly by plowing successive furrows in exactly the same manner. Subsequently, however, equipment traffic repacks some of the soil.

Investigators developing the experimental system hope to alleviate this difficulty by establishing three permanent soil zones—two on the surface and one in the plant root area. Each zone is "permanent" because it is reserved for only one purpose during any given test cycle.

Zone 1 consists of alternate furrows that accommodate equipment traffic and are not tilled. Zone 2, closed to traffic, is made up of the remaining furrows and is tilled as necessary for adequate water infiltration. Zone 3, subsurface zone, is treated periodi-

ABOVE—Engineers find that precision tillage, combined with deep placement of nematocide, is better than conventional tillage because it maintains cotton yields and reduces the number of root galls.

LEFT—These test plots received only three operations prior to preirrigation; normal tillage requires seven.

cally to encourage root penetration and development.

The Shafter scientists use stalk disposal machines and precision chisels with attachments for applying nematocide in their experimental system.

Each year after Christmas, they begin the tillage cycle by shredding the stalks at the same time they shred taproots to a depth of 8 to 14 inches. They then break up and loosen compacted subsoil with precision chisels 2 feet below the surface and, in a concurrent operation, apply nematocide at the bottom of the chisel slots. Cotton is later planted directly over these slots to permit better vertical rooting.

Only four preplant operations are necessary in the Shafter system: Shredding, chiseling to break up subsoil for better rooting, chiseling furrows to be irrigated, and preplant irrigation. This contrasts with nine separate operations required in conventional systems.

Cotton yields generally were approximately the same for both systems, ranging from 2½ to 2¾ bales per acre. After the first 50 days in 1964, however, plants on experimental plots weighed 21 percent more on a dry-weight basis than those on conventionally tilled plots. But this difference disappeared by midseason.

Of even more significance is the difference in number of tractor-hours required. It takes about 48 minutes of tractor time per acre to till the experimental plots, compared with approximately 2 hours, 47 minutes for the conventionally tilled plots. In terms of horsepower, the experimental system saves about 71 percent in total energy.

Future studies will include more detailed measurements of soil condition and evaluation of the efficiency of the new system from field to field and during different seasons.☆

How to Stop Seepage from Stock Ponds

Soil scientists add sodium carbonate to clay soil, making it nearly impermeable

■ Disking sodium carbonate into the soil of western stock ponds that dry up before the end of the grazing season can reduce seepage to less than one-fourth inch per day—and provide cattle with sufficient water throughout the season.

Soil scientist R. J. Reginato and director L. E. Myers of the U.S. Water Conservation Laboratory, Tempe, Ariz., analyzed soil samples taken from the bottom of test ponds after treatment. They found sodium carbonate had changed the grainy montmorillonite clay soil into nearly water-impermeable sodic soil.

This development is of major importance to farmers and ranchers in areas where pond seepage reduces water supplies and thus limits—or eliminates—grazing.

The chemical seals the soil by ion exchange. Positive-charged sodium ions become attached to negative-charged sites on clay particles. The sodium causes the clay particles to swell when wet, break apart, and fill the pores in the soil.

Many western clay soils are grainy and relatively porous because positive-charged calcium ions are attached to the clay particles in the soil. But when a sodium salt—for example, sodium carbonate—is mixed in the soil, the calcium ions become detached and are replaced by sodium ions. The calcium ions combine with the carbonate ions to form calcium carbonate, and insoluble salt.

Reginato and Myers say that many clay soils—those with 15 percent or more of the particle sites occupied by sodium ions—are practically impermeable to water. They found up to five times as much dispersed clay in the soil of the treated pond as in soil of untreated ponds.

(Clay soils that, in their natural state, have sodium ions attached to 15 percent or more of the sites are called sodic or black alkali. Many western farms contain areas of sodic soil that restrict water infiltration and limit plant growth.)

The researchers say that more study is needed on how long sodium-treated ponds will retain water. For example, a pond treated with sodium carbonate has proved successful for 2 years, but two stock ponds that were treated with another sodium salt, tetrasodium pyrophosphate (TSPP), began to leak after a little more than a year.

If calcium ions come into contact with sodium-sealed soil—from runoff or sediment entering the pond—the calcium ions will exchange with the sodium ions and increase the permeability of the soil. The researchers believe, however, that adding small quantities of sodium carbonate to the pond water periodically will prevent the additional calcium ions from increasing the seepage rate.

A 1-acre pond can be sealed with sodium carbonate for about $250. The cost of additional treatments would depend on the rate at which calcium ions reenter the soil. ☆

Utilization scientists make major advance toward . . .

Low-Cost Biological Control of Jap Beetles

■ Prospects have brightened for farmers and gardeners in northeastern and central states in controlling the Japanese beetle, destroyer of millions of dollars worth of field crops, ornamentals, and turf each year.

Scientists at the Northern utilization research laboratory, Peoria, Ill., have induced the bacteria (*Bacillus popilliae*) that causes milky spore disease in Japanese beetles to form spores in a liquid fermentation medium.

This opens the door to a low-cost industrial method of mass-producing the spores, which in turn could give rose gardeners and soybean growers, alike, a potent biological weapon against this pest. The urgency for a large-scale weapon is increasing, since the beetle is advancing into midwestern corn and soybean fields.

Although spores of *B. popilliae* are available commercially, present production methods are tedious and costly. Spores are now grown in diseased beetle grubs, each of which must be inoculated by hypodermic needle.

Heartened by their latest finding, the Peoria scientists are now seeking methods to increase the yield of spores, the only form in which the bacteria can survive in the soil. Once there, the spores are swallowed by beetle grubs feeding on plant roots and serve as an effective natural control.

The utilization scientists are also determining the best time to harvest spores from the liquid fermentation medium. Current work suggests that some spores were lost because they started to grow into vegetative cells before the culture was harvested. Another problem to be worked out is avoiding contamination in fermentations larger than those carried out in 300-ml. flasks.

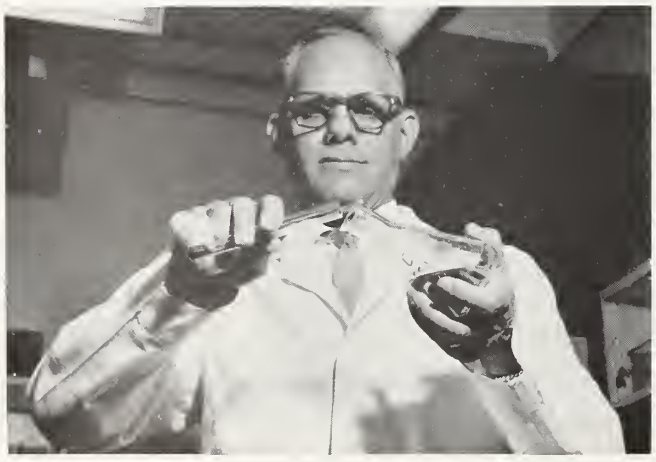
Working with a strain of *B. popilliae* that sporulates in a solid medium, microbiologist W. C. Haynes and biological laboratory technician L. J. Rhodes added activated carbon to a liquid medium developed in earlier Peoria studies. They found that bacterial cells not only produced spores, but they multiplied faster in the medium containing carbon, and the cells lived longer. The medium also contains corn sugar, yeast abstract, potassium phosphate and tryptone, a substance made from protein by enzymatic digestion.

Determining how carbon affects sporulation could provide scientists with a lead on increasing spore yield. If carbon adsorbs toxic materials from the nutrients, for example, it may be possible to formulate a nutrient solution that is not toxic to the disease cells.

The current fermentation studies were carried out at 77° F. in 300-milliliter flasks (about 10-ounce capacity), each containing 100 ml. of nutrient solution. The flasks were placed on a shaker and agitated so that air was mixed with the cells and medium.

The scientists did not determine the

Microbiologist Haynes (left) adds the vital element—carbon—to the liquid medium in which small amounts of spores were produced. After putting dried spores into soil (right), biological laboratory technician Rhodes found that they were still viable after 6 months' storage.

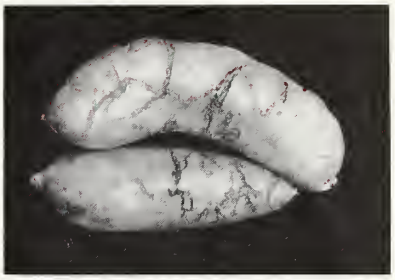


yield of spores at harvest, but, 4 days after adding the culture to soil, they noted that as many as 10,000 spores survived per ml. of culture. Although this number is too small to be industrially practical, it represents a step toward commercial production.

In testing survival ability, the scientists first dried the spores and then stored them for various periods under different environmental conditions. The spores survived storage for 6 months in soil and for 4 months in air, sand, and a mixture of talc and calcium carbonate. A talc-calcium carbonate mixture is used as a carrier for commercially produced milky disease spore dust.

Intensive investigations (AGR. RES., August 1963, p. 3) provided information on how to grow milky disease bacterial cells outside the grub's body. This led to the use of industrial fermentation techniques to produce bacterial cells of *B. popilliae* and cause them to form spores.☆

Possible? Sweet Potatoes That Resist 15 Insect Pests



New sweet potato strains may resist tunnel damage of sweet potato flea beetle larvae.

■ Entomologists are seeking an answer to the question: How well do sweet potato varieties and breeding lines resist a complex of 15 insect pests?

So far, 48 lines of sweet potatoes have been graded according to the susceptibility of edible roots to insect attack.

ARS entomologists F. P. Cuthbert, Jr., C. S. Creighton, and W. J. Reid, Jr., are doing the research at Charleston in cooperation with the South Carolina and Louisiana Agricultural Experiment Stations. Louisiana supplied most of the sweet potato varieties and breeding lines.

Results of the Charleston research are being supplied to plant breeders who will use the information in breeding new varieties.

In his studies on susceptibility to insect attack, Cuthbert has found, among the most destructive insects, southern potato wireworms, sweet potato flea beetles, banded cucumber beetles, and spotted cucumber beetles.

He found that 70 percent or more of the roots of 15 of the 48 varieties and lines had been damaged to the extent that they were placed in the unsaleable category. Roots from only 8 varieties or lines suffered less than 50 percent damage; roots of 6 lines had less than 45 percent injury; and roots from one of these breeding line—L3–64—had 21 percent damage.

Although the extent of damage appears high, the entomologists say that controlling the 15 soil insects in sweet potatoes would be greatly simplified—if commercial varieties were available having resistance equal to the best breeding lines in their studies.

Besides rating lines for resistance Cuthbert joined Creighton in trying to discover why some varieties are more resistant to insects than others. Earlier evaluations were based largely on studies of sweet potato flesh. More recent research has shown, however, that the skin of the sweet potato also helps determine the degree of resistance. In fact, the highly resistant varieties have skin and flesh that resist insect attack.

The studies have turned up still other new information. Although the adult flea beetle has long been known to attack sweet potato foliage, the larva of this insect was not known to damage tubers. Cuthbert and Reid found larvae of the beetle associated with damage to roots. The damage (see photo) consists of long winding tunnels in roots. This damage has been serious in sweet potato crops from Georgia to Maryland in recent years. Until now, the exact cause of these root injuries had not been known.☆

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AGRISEARCH NOTES

Engineers test cotton precleaner

A machine that precleans exceptionally trashy cotton before ginning is being developed by ARS scientists.

The experimental machine—known as a limb and stalk remover—is especially designed to take out limbs, leaves, stalks, and other heavy trash that conventional cleaning equipment cannot handle economically. Heavy trash is often picked up in mechanical gleaning of cotton that is missed during the regular harvest season or is knocked down by wind, rainstorms, or hurricanes.

Agricultural engineer G. N. Franks and cotton technologist C. S. Shaw developed the new precleaner, which has saws that are similar to gin saws and a stationary steel wire brush that directs the cotton onto the saw teeth. It does not have the grid bars and channel saws of conventional cleaning equipment.

A pilot model of the machine was tested by the scientists at Stoneville, Miss., on eight types of harvested cotton, including some that was very trashy. Its performance was satisfactory in all the tests; it did not cause neps (small tangles of fibers) nor did it affect fiber length or strength adversely.

The researchers have applied for a public service patent on the precleaner.

When put through the precleaner, mechanically gleaned cotton (A) yields seed cotton (B) and limbs and stalks (C).

PPLO organism may cause abortion

A pleuropneumonia-like organism may be a cause of infertility and abortion in cows, preliminary ARS experiments indicate.

Classified somewhere between viruses and bacteria, the organism (PPLO-Mycoplasma) can cause pneumonia in man and animals, sinusitis and air sac infection in turkeys, and chronic respiratory disease (CRD) in chickens. Strains of PPLO are found in bull semen and could be passed on to cows through breeding. The organisms are relatively insensitive to antibiotics commonly used in semen.

The organisms were isolated from the fourth stomach of an aborted calf in research conducted by ARS scientists P. A. O'Berry, J. H. Bryner, and A. H. Frank at the National Animal Disease Laboratory, Ames, Iowa. Although not yet proved, this suggests the organisms may have caused the abortion.

The PPLO organisms isolated from the aborted calf differ from those isolated from the vaginas of several normal cows in herds having histories of breeding difficulties—and from other strains of disease-producing Mycoplasma.

The scientists are now studying the new strain as part of their efforts to pinpoint the causes of many "unexplained" abortions in cattle herds. The cause is unknown in about three-fourths of aborted calves examined by veterinary laboratories.

CAUTION: In using pesticides discussed in this publication, follow directions and heed precautions on pesticide labels. Be particularly careful where there is danger to wildlife or possible contamination of water supplies.

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